

AMENDMENTS TO THE CLAIMS

1-24. (cancelled)

25. (currently amended) An optical measurement and inspection method comprising:

providing at least two light emitters,

providing at least one light receiver,

providing at least one signal generator connected to at least one of the light emitters and the at least one ~~of the~~ light ~~receivers~~ receiver, and

providing means for converting the received light to electrical current, wherein

providing a sheet of material that lies or traverses between and/or in front of the at least two light emitters and the at least one light receiver (200),

controlling, with the at least one signal generator, at least one of the light emitters and the at least one light receiver by sending them an electronic synchronisation signal and thereby synchronises emission and detection of light rays (205, 215, 245),

fixing a common carrier waveform AC voltage signal in frequency, and a symmetrical 50% duty cycle ~~square~~ wave signal is processed from the common carrier AC voltage waveform signal and ~~carries the common carrier waveform AC voltage signal and the 50% duty cycle wave signal~~ carry equal frequency and phase in terms of zero-crossings,

driving, with the at least one signal generator, the at least two light emitters with different carrier frequencies waveforms and/or phases, and the at least one light receiver with both of these frequencies, waveforms and/or phases,

emitting, with the at least two light emitters, at least two rays of light (220),

the at least two rays of light being incident on the stationary or traversing sheet (225),

detecting by the same light receiver (230) at least two rays of light grazing the sheet, transparent to the sheet, reflected from the sheet or directly from the light emitters,

an intensity of at least one said emitted ray of light follows at least one of the carrier waveform signals and at least one said detected light ray is demodulated from the carrier waveform signal using the electronic synchronisation signal,

converting at least two of the rays of light to photocurrent (240), and the symmetrical ~~square~~ wave signal, processed from the common carrier waveform signal, is ~~used~~ configured for rectifying photocurrent signal,

removing at least one DC component from the photocurrent signal, and

diagnosing and observing the processed photocurrent and/or changes in the processed photocurrent to find defects and/or determine characteristics of the said sheet of material (250),

wherein at least one said carrier waveform signal is a sine wave, cosine wave, or a square wave signal.

26. (previously presented) The optical measurement and inspection method in accordance with claim 25, wherein different rays of light from different emitters targeted to the same receiver measure different properties of the material sheet.

27. (currently amended) The optical measurement and inspection method in accordance with claim 26, wherein ~~[[the]]~~ a three dimensional structure of a defect is detected with more than one of the rays of light.

28. (canceled)

29. (currently amended) The optical measurement and inspection method in accordance with claim 25, wherein the photocurrent is converted to a voltage upon rectifying the photocurrent signal.

30. (currently amended) The optical measurement and inspection method in accordance with claim 29, wherein the resulting photocurrent or voltage is amplified upon detecting by the same light receiver.

31. (currently amended) The optical measurement and inspection method in accordance with claim 25, wherein the resulting photocurrent or a voltage converted from the photocurrent during rectifying is fed into a fault detection circuit (80) that comprises:

- means for summing 820, 823 a positive or negative threshold voltage value to the voltage signal entering the fault detection circuit,
- a low pass filter signal path (825),
- means for resetting the circuit (850),
- means for generating digital defect signal pulses 840, 843 when ~~analog~~ signals exceeding preset threshold values are produced by demodulation- or synchronised detection circuitry of the measurement and inspection method.

32. (previously presented) The optical measurement and inspection method in accordance with claim 25, wherein the sheet material (410, 510, 610, 710) is paper, steel, plastic, metal, rubber, aluminium foil, copper foil, film, or coated metal sheet.

33. (previously presented) The optical measurement and inspection method in accordance with claim 25, wherein location and/or size of at least one defect and/or other attributes of at least one defect and/or sheet width, thickness, length, density, reflectivity, purity or other physical

attributes of the sheet are derived from optical measurements performed by the method.

34. (currently amended) The optical measurement and inspection method in accordance with claim 25, wherein the arrangement is configured to detect one or more defects that [[may]] feature aspects of the following: holes, pinholes, scratches, spots, stains, cracks, edge faults, streaks, or surface faults.

35. (currently amended) The optical measurement and inspection method in accordance with claim 25, wherein at least one light detector (520, 570, 720), ~~and/or~~ detector module (430, 560, 630) ~~and/or~~ or detector array (420, 620) ~~comprises~~ comprise at least one photoelectric device (530, 730), lens (550, 750) ~~and/or~~ or wave guide (540, 740).

36. (previously presented) The optical measurement and inspection method in accordance with claim 25, wherein the signal generator drives at least two light receivers with different carrier frequencies, waveforms and/or phases.

37. (currently amended) An optical measurement and inspection arrangement, comprising:

at least two light emitters,  
at least one light receiver,

at least one signal generator connected to at least one of the light emitters and at least one of the light receivers, and

means for converting the received light to electrical current, wherein

- a sheet of material (410, 510, 610, 710) is arranged between and/or in front of the at least two light emitters (400, 500, 600, 700) and the at least one light receiver (420, 520, 620, 720),

- the at least two light emitters (400, 500, 600, 700) are arranged to emit at least two rays of light incident on at least one sheet,

- at least two rays of light grazing the sheet, transparent to the sheet or reflected from the sheet are arranged to be detected by the same at least one light receiver (420, 520, 620, 720),

- at least one ray of light is arranged to be converted to photocurrent by at least one photoelectric device (530, 630, 730)

- the at least one signal generator is arranged to control at least one of the light emitters (400, 500, 600, 700) and at least one of the light receivers (420, 520, 620, 720) by sending them an electronic synchronisation signal and thereby synchronises the emission and detection of rays,

- a common carrier waveform AC voltage signal is fixed in frequency, and a symmetrical 50% duty cycle square wave signal

is processed from ~~[[a]]~~ the common carrier AC voltage waveform signal and carries the common carrier waveform AC voltage signal and the 50% duty cycle wave signal carry equal frequency and phase in terms of zero-crossings,

- the at least one signal generator is arranged to drive the at least two light emitters with different carrier frequencies, waveforms and/or phases, and the at least one light receiver with both of these frequencies waveforms and/or phases,

- an intensity of at least one said emitted ray of light is arranged to follow ~~[[a]]~~ at least one of the carrier waveform signals and at least one received light ray is arranged to be demodulated from the carrier waveform signal using the electronic synchronisation signal,

- the symmetrical ~~square~~ wave signal, processed from the common carrier waveform signal, is ~~used~~ configured for rectifying photocurrent signal,

- at least one DC component is removed from the photocurrent signal, and

- the photocurrent and/or changes in photocurrent are arranged to be diagnosed and observed to find defects and/or determine characteristics of the said sheet of material (310), wherein at least one of said carrier waveform signal is a sine wave, cosine wave, or a square wave signal.

38. (previously presented) The optical measurement and inspection arrangement in accordance with claim 37, wherein

different rays of light from different emitters arranged to be targeted to the same receiver are arranged to measure different properties from the material sheet.

39. (previously presented) The optical measurement and inspection arrangement in accordance with claim 37, wherein a three dimensional structure of a defect is arranged to be detected with more than one of the rays of light.

40. (canceled)

41. (currently amended) The optical measurement and inspection arrangement in accordance with claim 37, wherein the resulting photocurrent or a voltage converted from the photocurrent during rectifying is fed into a fault detection circuit (80) that comprises,

- means for summing a positive or negative threshold voltage value to the voltage signal entering the fault detection circuit 820, 823.

- a low pass filter signal path (825),

- means for resetting the circuit (850), and

- means for generating digital defect signal pulses 840, 843 when ~~analog~~ defect signals exceeding preset threshold values are produced by demodulation- or synchronised detection circuitry of the measurement and inspection arrangement.



42. (previously presented) The optical measurement and inspection arrangement in accordance with claim 37, wherein the sheet material (310, 410, 510, 610) is paper, steel, plastic, metal, rubber, aluminium foil, copper foil, film or coated metal sheet.

43. (currently amended) The optical measurement and inspection arrangement in accordance with claim 37, wherein a location and/or size of at least one defect ~~and/or~~ or other attributes of at least one defect ~~and/or~~ or sheet width, thickness, length, density, reflectivity, purity or other physical attributes of the sheet are derived from optical measurements performed by the arrangement.

44. (currently amended) The optical measurement and inspection arrangement in accordance with claim 37, wherein the arrangement is configured to detect one or more defects that [[may]] feature aspects of the following: holes, pinholes, scratches, spots, stains, cracks, edge faults, streaks, or surface faults.

45. (currently amended) The optical measurement and inspection arrangement in accordance with claim 37, wherein at least one of said light receivers ~~and/or~~ or means for converting the received light (420, 520, 560, 570, 620, 630, 720) comprises

at least one photodetector (530, 730), lens (550, 750) ~~and/or~~ or  
wave guide (540, 740).

46. (previously presented) The optical measurement and inspection arrangement in accordance with claim 37, wherein the signal generator is arranged to drive at least two light receivers with different carrier frequencies, waveforms and/or phases.